

## CLAIMS

1. An optical communication system (10) comprising:

- (a) first and second optical paths (20, 30, 40, 50, 60; 200, 210; 220, 230) for guiding information-bearing optical radiation partitioned into wavebands;
- (b) interfacing means (70, 80, 90, 100, 110, 120) for selectively communicating radiation components corresponding to one or more of the wavebands from the first path (200, 210) to the second path (220, 230), the interfacing means (70, 80, 90, 100, 110, 120) comprising waveband selective diverting means (250, 260) and waveband selective coupling means (280, 300, 320, 330, 470, 480, 490, 500, 600, 630), the diverting means (250, 260) being included in the first path (200, 210) and operable to divert radiation components corresponding to one or more of the wavebands from the first path to provide diverted radiation, and the coupling means (280, 300, 320, 330, 470, 480, 490, 500, 600, 630) being operable to couple one or more radiation components present in the diverted radiation to the second path (220, 230),

characterised in that the diverting means includes:

- (c) waveband selective filtering means (800) for separating at least part of the information-bearing radiation propagating along the first path into spatially separated rays, each ray corresponding to radiation of an associated waveband; and
- (d) liquid crystal attenuating means (818, 820, 825) associated with each ray for selectively directing radiation corresponding to the waveband of the ray, the directed radiation contributing to the diverted radiation provided to the coupling means.

2. A system according to Claim 1, wherein the coupling means includes:

- (a) waveband selective filtering means (800) for separating at least part of the diverted radiation into spatially separated rays, each ray corresponding to an associated waveband; and
- (b) liquid crystal attenuating means (818, 820, 825) associated with each ray for selectively transmitting or diverting radiation corresponding to the waveband of the ray, thereby selectively providing radiation for output to the second path.

3. A system according to Claim 1 or 2 wherein the second path includes waveband selective attenuating means (350, 360) for attenuating radiation of wavebands propagating along the second path (220, 230), the coupling means operable to add radiation originating from the first

path to radiation output from the attenuating means, the attenuating means operable to attenuate radiation of wavebands propagating along the second path coincident in wavelength with radiation added by the coupling means.

4. A system according to Claim 3 wherein the attenuating means includes:

- (a) waveband selective filtering means (800) for separating the radiation propagating along the second path into spatially separated rays, each ray corresponding to radiation of an associated waveband; and
- (b) liquid crystal attenuating means (818, 820, 825) associated with each ray for selectively transmitting or diverting radiation corresponding to the waveband of the ray, thereby selectively providing radiation for adding to that from the coupling means for further propagation along the second path.

5. A system according to any preceding claim wherein the diverting means, the attenuating means and the coupling means operate on the information-bearing radiation in the optical domain to couple at least a part of the radiation from the first path to the second path without needing to convert any part of the radiation into a corresponding electrical signal and back to corresponding optical radiation.

6. A system according to any one of Claims 1 to 5 wherein the waveband selective coupling means includes waveband switching means (1332, 1410) for transferring information conveyed on a first set of the wavebands of the diverted radiation to a second set of the wavebands in the diverted radiation output to the second path.

7. A system according to Claim 6 wherein the waveband switching means comprises waveband selecting means for isolating radiation of a selected waveband in the diverted radiation, detecting means (1310) for converting the isolated radiation into a corresponding electrical signal, and an optical radiation source (1320) modulatable by the signal and operable to generate radiation bearing the signal and at a waveband mutually different to the selected waveband, the generated radiation for output to the second path.

8. A system according to Claim 6 wherein the waveband switching means comprises waveband selecting means for isolating radiation of a selected waveband in the diverted radiation, and an optical radiation source (1430) biased substantially at its lasing threshold

(1440), the source (1430) being operable to be stimulated by the isolated radiation such that stimulated radiation generated by the source (1430) is modulated by information carried by the isolated radiation, the stimulated radiation being at a waveband mutually different to the selected waveband, the stimulated radiation for output to the second path.

9. A system according to any preceding claim wherein the coupling means incorporates regenerating means (440, 850, 852, 854, 856, 858, 860, 862, 864) for regenerating the diverted radiation propagating therethrough.

10. A system according to any preceding claim wherein the first and second paths are operable to support bi-directional radiation propagation therealong, and the interfacing means is operable to couple radiation of one or more of the wavebands propagating in either direction along the first path to the second path for propagation in either direction therealong.

11. A system according to any preceding claim wherein the paths include one or more of linear paths and ring paths.

12. A system according to any preceding claim wherein at least one of the paths is operable to support bi-directional radiation propagation therealong, the at least one path including redirecting means for coupling radiation of one or more wavebands from a first direction of radiation propagation to a second direction of radiation propagation along the at least one path, the second direction being mutually oppositely directed to the first direction.

13. An interface (70, 80, 90, 100, 110, 120) for an optical communication system (10) comprising:

- (a) first and second optical paths for guiding information-bearing optical radiation partitioned into wavebands, the interface operable to selectively communicate radiation corresponding to one or more of the wavebands from the first path to the second path,
- (b) waveband selective diverting means and waveband selective coupling means, the diverting means being included in the first path and operable to divert radiation corresponding to the one or more of the wavebands from the first path to provide diverted radiation, and the coupling means is operable to couple radiation of one or more wavebands present in the diverted radiation to the second path,

characterised in that the diverting means includes:

- (c) waveband selective filtering means (800) for separating at least part of the information-bearing radiation into spatially separated rays, each ray corresponding to radiation of an associated waveband; and
- (d) liquid crystal attenuating means (818, 820, 825) associated with each ray for selectively directing radiation corresponding to the waveband of the ray, the directed radiation contributing to the diverted radiation for the coupling means.

14. An interface according to Claim 13 wherein the coupling means includes:

- (a) waveband selective filtering means (800) for separating at least part of the diverted radiation into spatially separated rays, each ray corresponding to radiation of an associated waveband; and
- (b) liquid crystal attenuating means (818, 820, 825) associated with each ray for selectively transmitting or diverting radiation corresponding to the waveband of the ray, thereby selectively providing radiation for output to the second path.

15. An interface according to Claims 13 or 14 wherein the diverting means and the coupling means operate on the information-bearing radiation in the optical domain to couple at least a part of the radiation from the first path to the second path without needing to convert any part of the radiation into a corresponding electrical signal and back to corresponding radiation.

16. An interface according to Claim 13, 14 or 15 wherein the waveband selective coupling means includes waveband switching means (1332, 1410) for transferring information conveyed on a first set of the wavebands of the diverted radiation to a second set of the wavebands in the diverted radiation output to the second path.

17. An interface according to Claim 16 wherein the waveband switching means (1400) comprises waveband selecting means for isolating radiation of a selected waveband in the diverted radiation, and an optical radiation source (1420) biased substantially at its lasing threshold (1440), the source (1420) being operable to be stimulated by the isolated radiation such that stimulated radiation generated by the source is modulated by information carried by the isolated radiation, the stimulated radiation being at a waveband mutually different to the selected waveband, the stimulated radiation for output to the second path.

18. An interface according to Claim 16 wherein the waveband switching means (1332) comprises waveband selecting means for isolating radiation of a selected waveband in the diverted radiation, detecting means (1310) for converting the isolated radiation into a corresponding electrical signal, and an optical radiation source (1320) modulatable by the signal and operable to generate radiation bearing the signal and at a waveband mutually different to the selected waveband, the generated radiation for output to the second path.
19. An interface according to any one of Claims 13 to 18 wherein the coupling means incorporates regenerating means (440, 850, 852, 854, 856, 858, 860, 862, 864) for regenerating the diverted radiation propagating therethrough.
20. An interface according to any one of Claims 13 to 19 wherein the first and second paths are operable to support bi-directional radiation propagation therealong, and the interface is operable to couple radiation of one or more of the wavebands propagating in either direction along the first path to the second path for propagation in either direction therealong.
21. A method of communicating information-bearing radiation from a first path to a second path of a system as claimed in Claim 1, the method comprising the steps of:
- (a) propagating the information-bearing radiation along the first path to interfacing means of the system;
  - (b) applying the radiation to diverting means of the interfacing means;
  - (c) separating at least part of the information-bearing radiation received at the diverting means into spatially separated rays, each ray corresponding to radiation of an associated waveband;
  - (d) receiving each ray at associated liquid crystal attenuating means and selectively diverting radiation at the attenuating means corresponding to one or more of the wavebands in the information-bearing radiation to provide diverted radiation; and
  - (e) coupling radiation of one or more wavebands of the diverted radiation through coupling means to the second path.